



Adaptive Management in Action: The South San Francisco Bay Salt Pond Restoration Project.

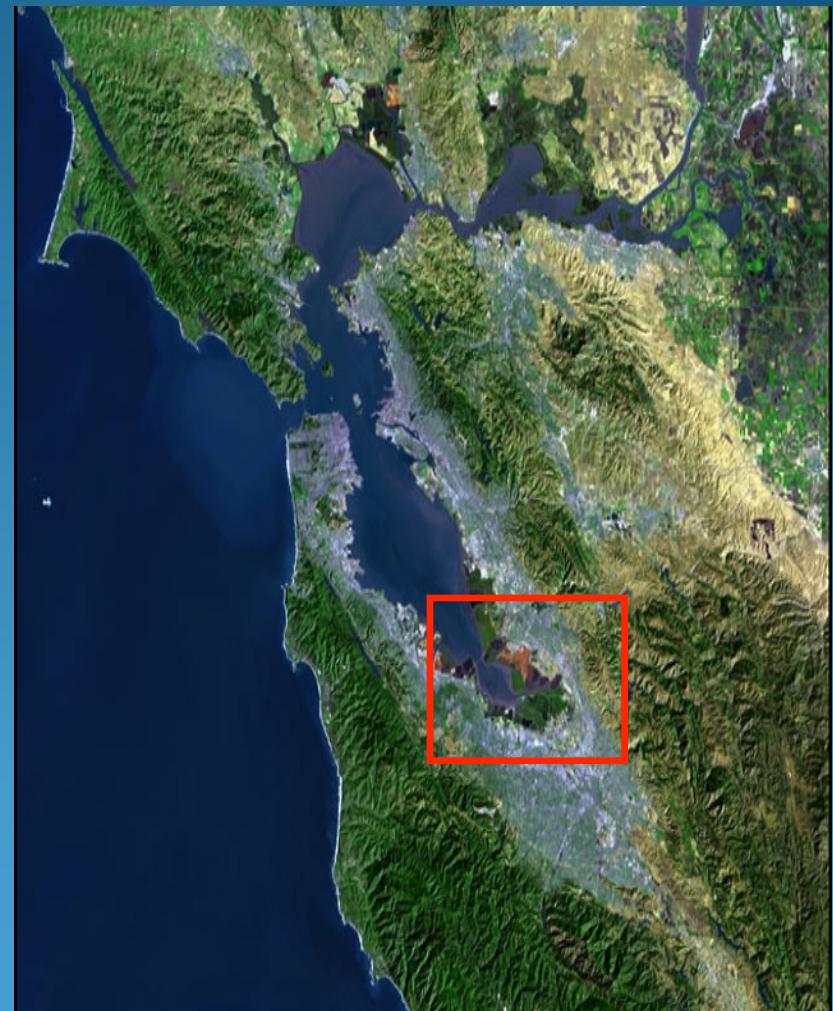
Photo Pelican Media

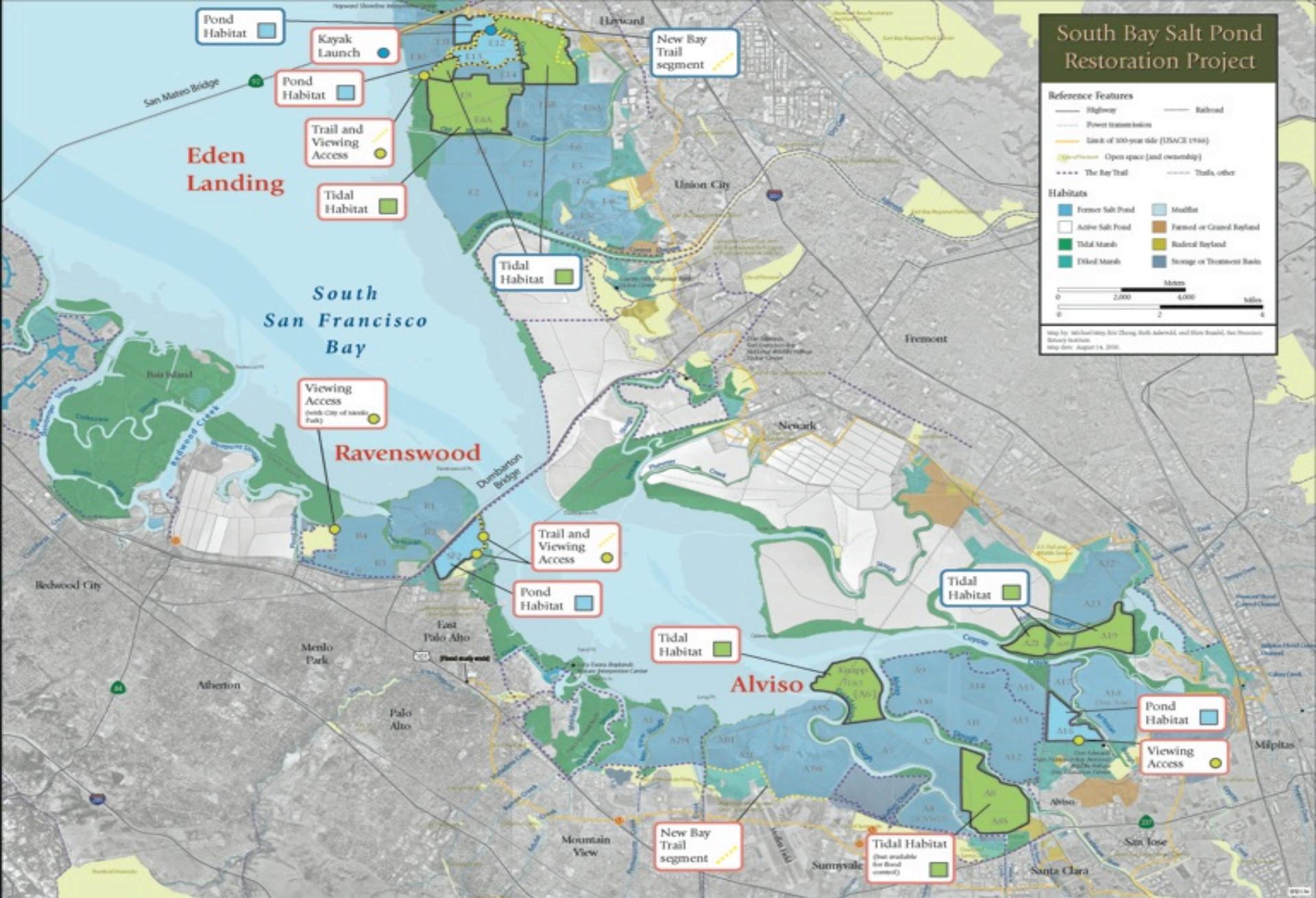
*Laura Valoppi, USGS, Western Ecological Research Center
Lead Scientist , South SF Bay Salt Pond Restoration Project*



San Francisco Bay

- Restoring the wildlife habitat
- Recreation access for 4+ million people
- Flood Protection for Silicon Valley





Initial Restoration Actions

South Bay Salt Pond Restoration Project

2006 - 07

proposed 2008

Why restore tidal marsh?

- 90% of historic SFB tidal marshes have been lost to development
- Many tidal marsh species are now threatened or endangered
- Conversion of salt ponds to marsh is critical for the recovery of these species



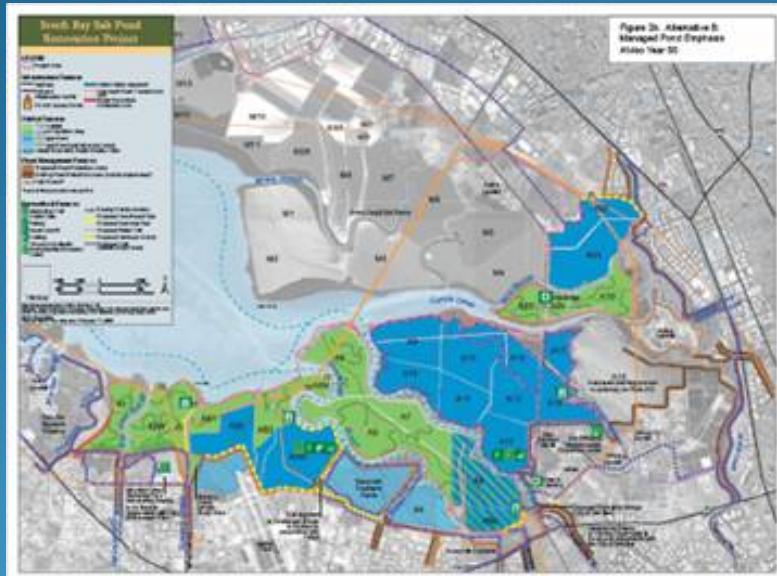
Some Tidal Marsh Species:
Ridgway's Rail
Salt Marsh Harvest Mouse
Song Sparrows
California Black Rail

Why manage ponds?

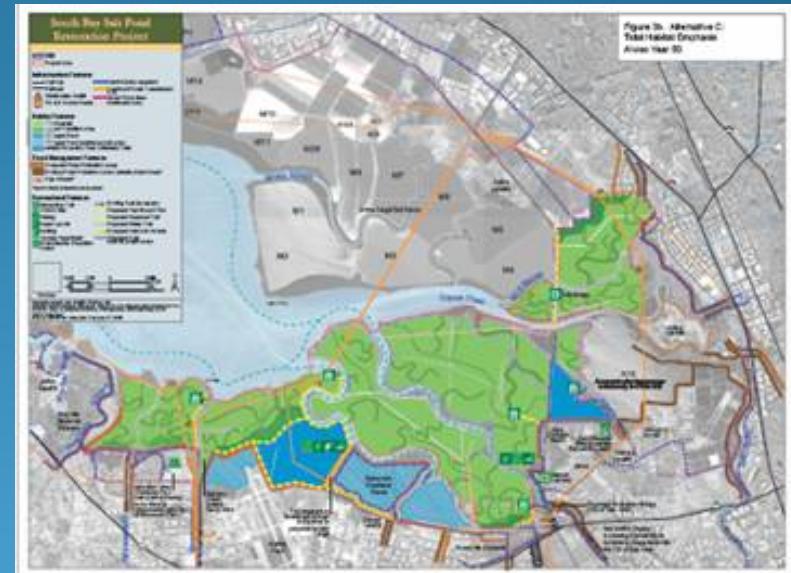
- Key habitats for dense migratory bird populations in migration and winter
- Pacific Flyway Migration and Wintering Area for water birds
- Western Hemispheric Shorebird Reserve Network
- These species don't use mature vegetated tidal marsh



South Bay Salt Pond Restoration Proposed Alternatives



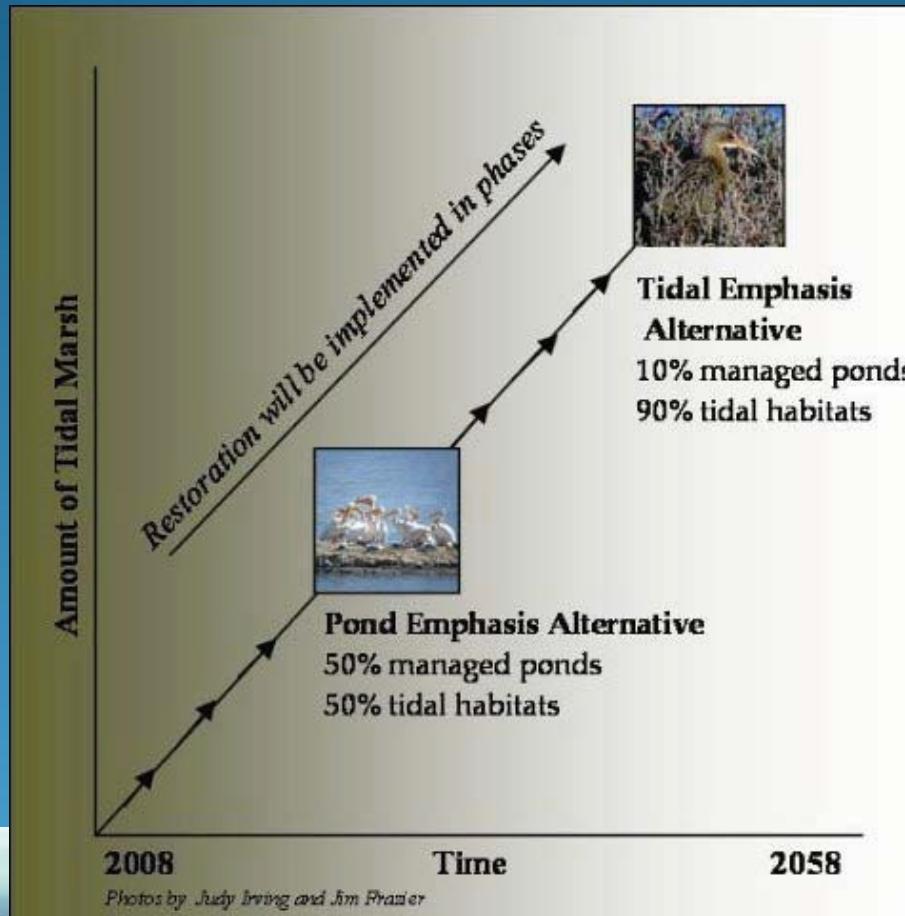
Managed Pond Emphasis



Tidal Marsh Emphasis



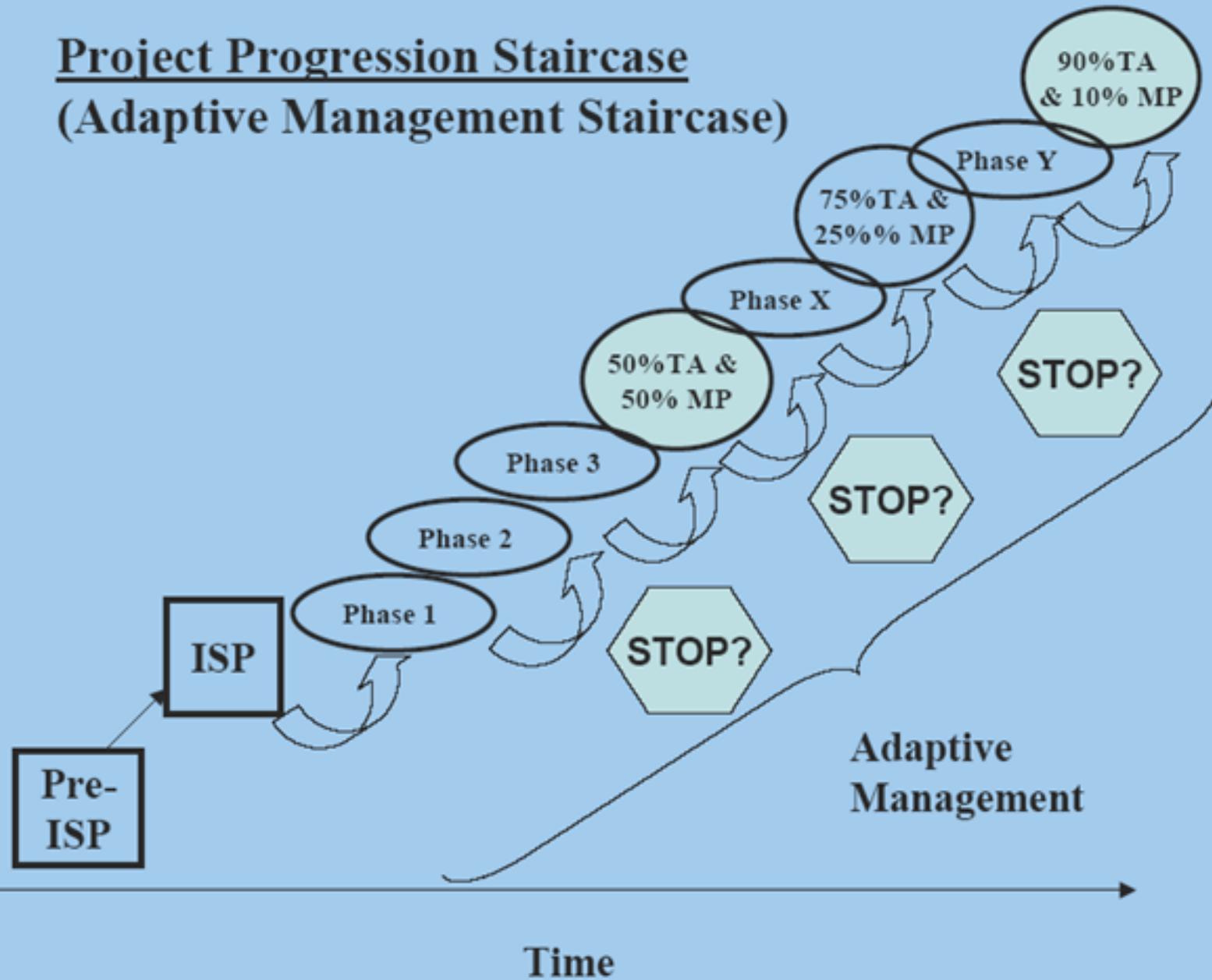
Managed Pond versus Salt Marsh



100%
tidal
action

Tidal Action (acres of significant tidal exchange)

Project Progression Staircase (Adaptive Management Staircase)



What is Adaptive Management ?



How are the ponds restored to marsh?





April 2008



September 2009



May 2010



October 2010



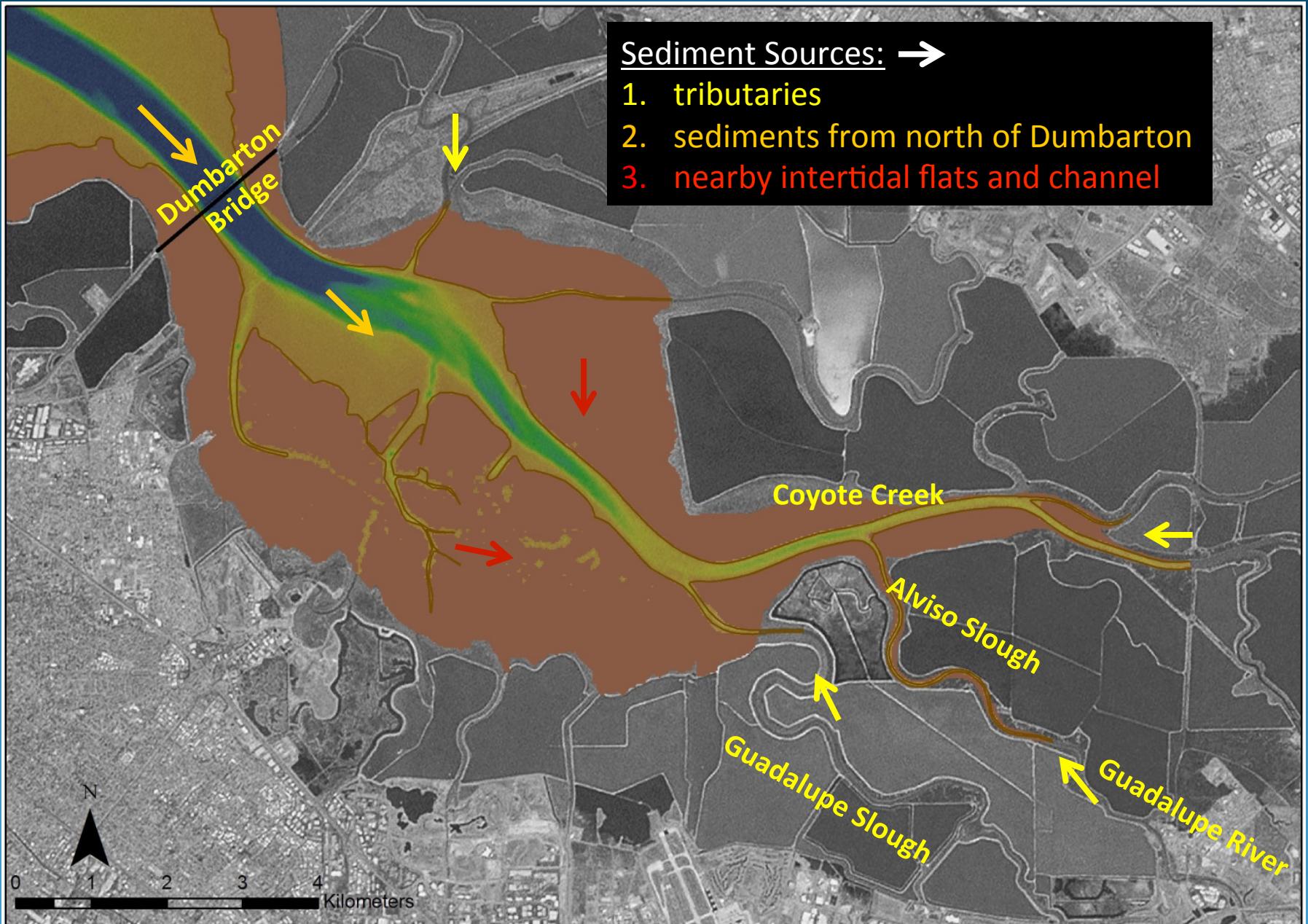
June 2011



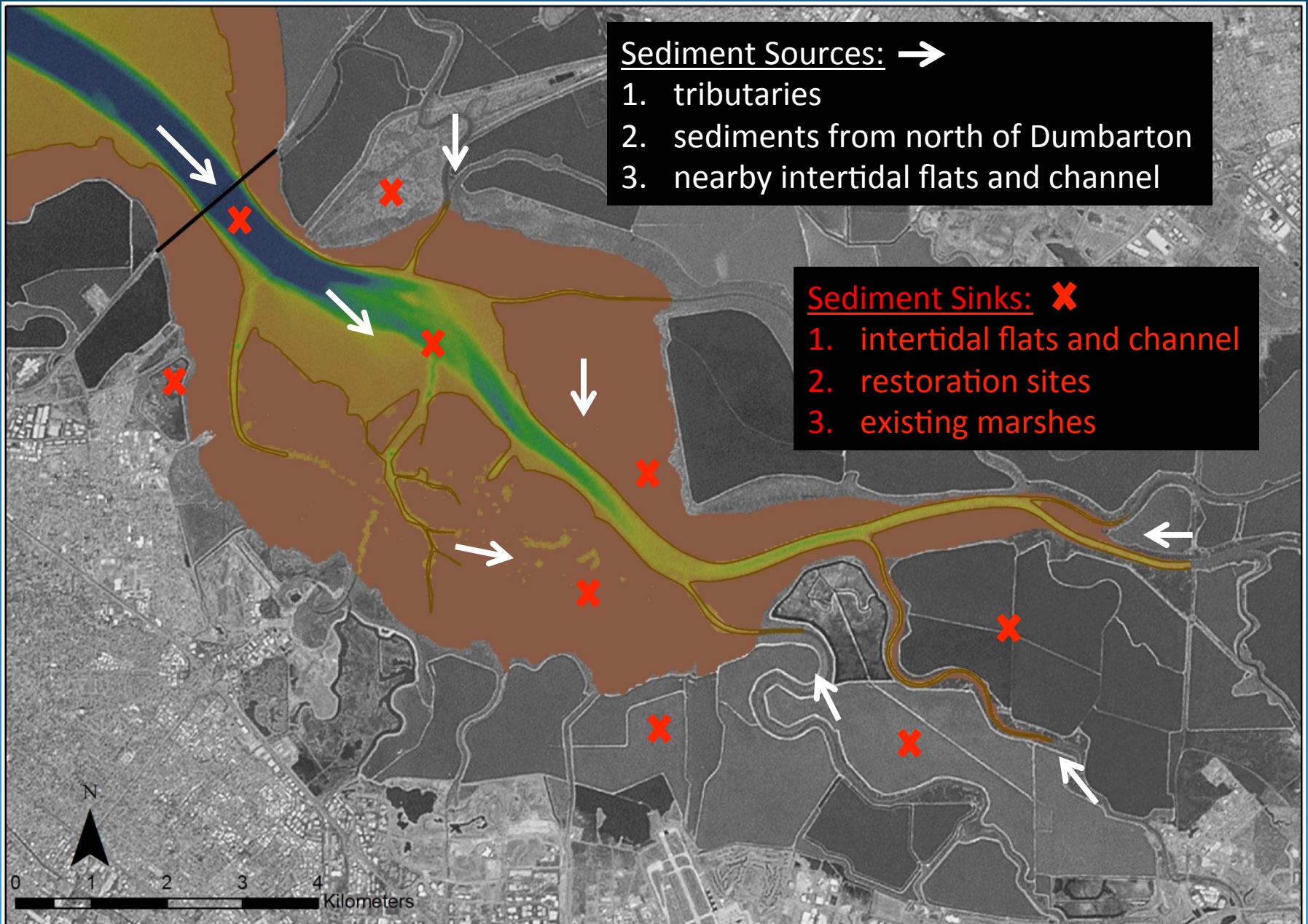
October 2011

Key Uncertainties

- Will there be enough sediment to fill ponds?
- How will restoration affect mudflat habitat?
- How will restoration affect birds, fish?
- How will nuisance species affect restoration?
- Will legacy mercury be a problem?
- How will trail use affect wildlife?
- How to manage pond water quality?
- How will climate change and SLR affect restoration?



see Shellenbarger et al., in press



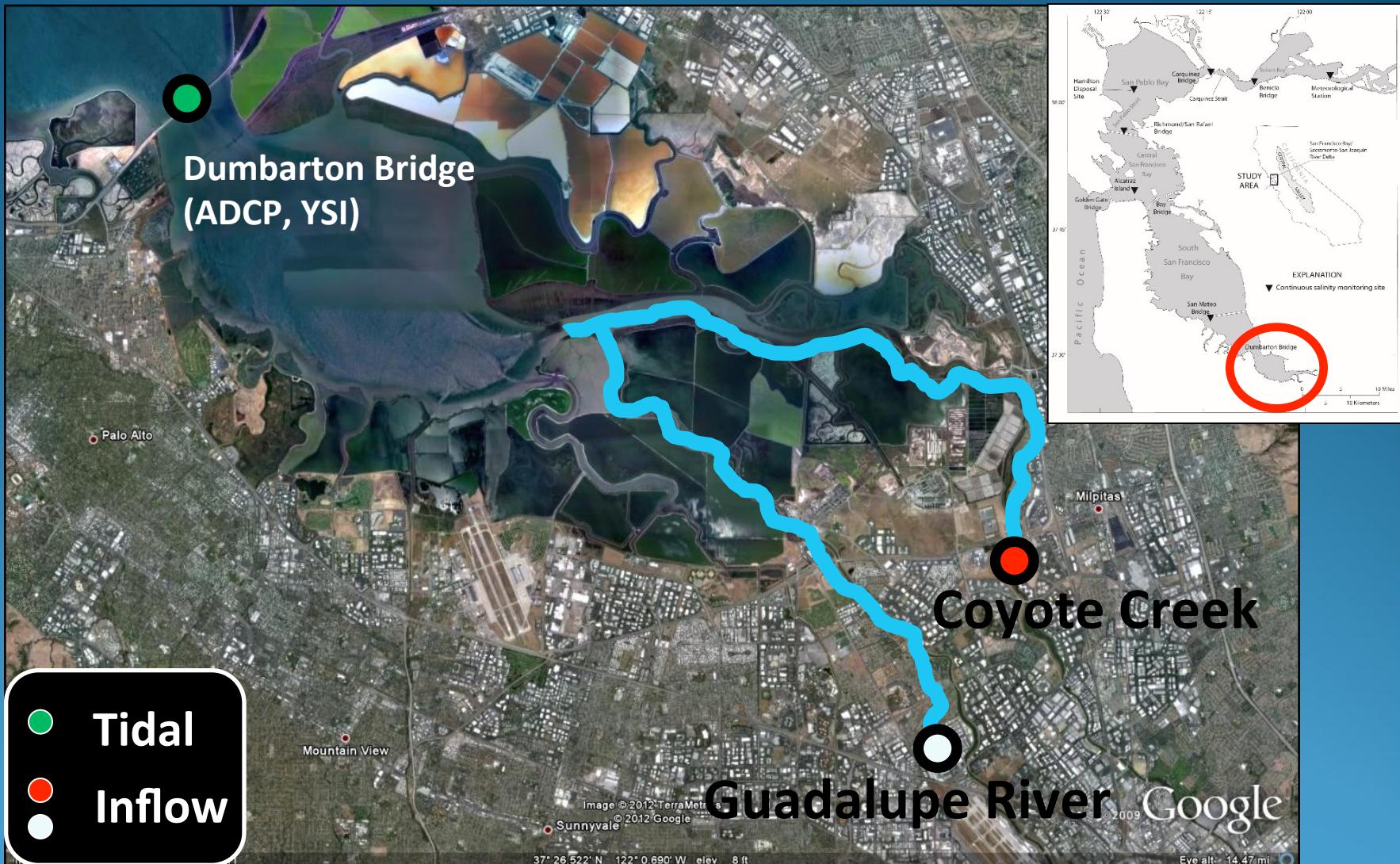
Sediment Uncertainties

- Sediment supply coming into South Bay
- Sediment accumulation in breached ponds
- Restoration impacts on scour and mudflats
- Impact of Climate Change and Sea Level Rise (SLR)

Excerpt from South Bay Salt Pond Restoration Project Adaptive Management Plan

CATEGORY/	RESTORATION TARGET	MONITORING PARAMETER (METHOD)	SPATIAL SCALE FOR MONITORING RESULTS	EXPECTED TIME FRAME FOR DECISION-MAKING	MANAGEMENT TRIGGER	APPLIED STUDIES	POTENTIAL MANAGEMENT ACTION
Sediment Dynamics Project Objective 1	1. No decrease in mudflat or subtidal channel habitat	1. Area of mudflats	1. Pond Complex level and South Bay	1. 10-20 years for mudflats; 0-5 years for channels	1. Mudflat decreases greater than natural variability	1. Will sediment move from mudflats to restored areas; will this impact biota?	1. Studies; slow restoration; redesign restorations.
	2. Accretion rate of ponds is sufficient to create marsh	2. Sedimentation rate inside breached ponds	2. Pond scale	2. Two to 10 years depending on initial elevation	2. Projected accretion rates	2. Is there enough sediment to create new marsh?	2. Studies; slow restoration; redesign restorations.
	3. No long-term net loss of tidal marsh in S. Bay	3. Total area of marsh in S. Bay	3. Pond Complex level and South Bay	3. 10 to 20 years	3. Observed net loss of marsh greater than natural variability	3. Is there enough sediment to maintain existing marsh and create new?	3. Studies; slow restoration; redesign restorations.

Sediment Supply - Study Locations

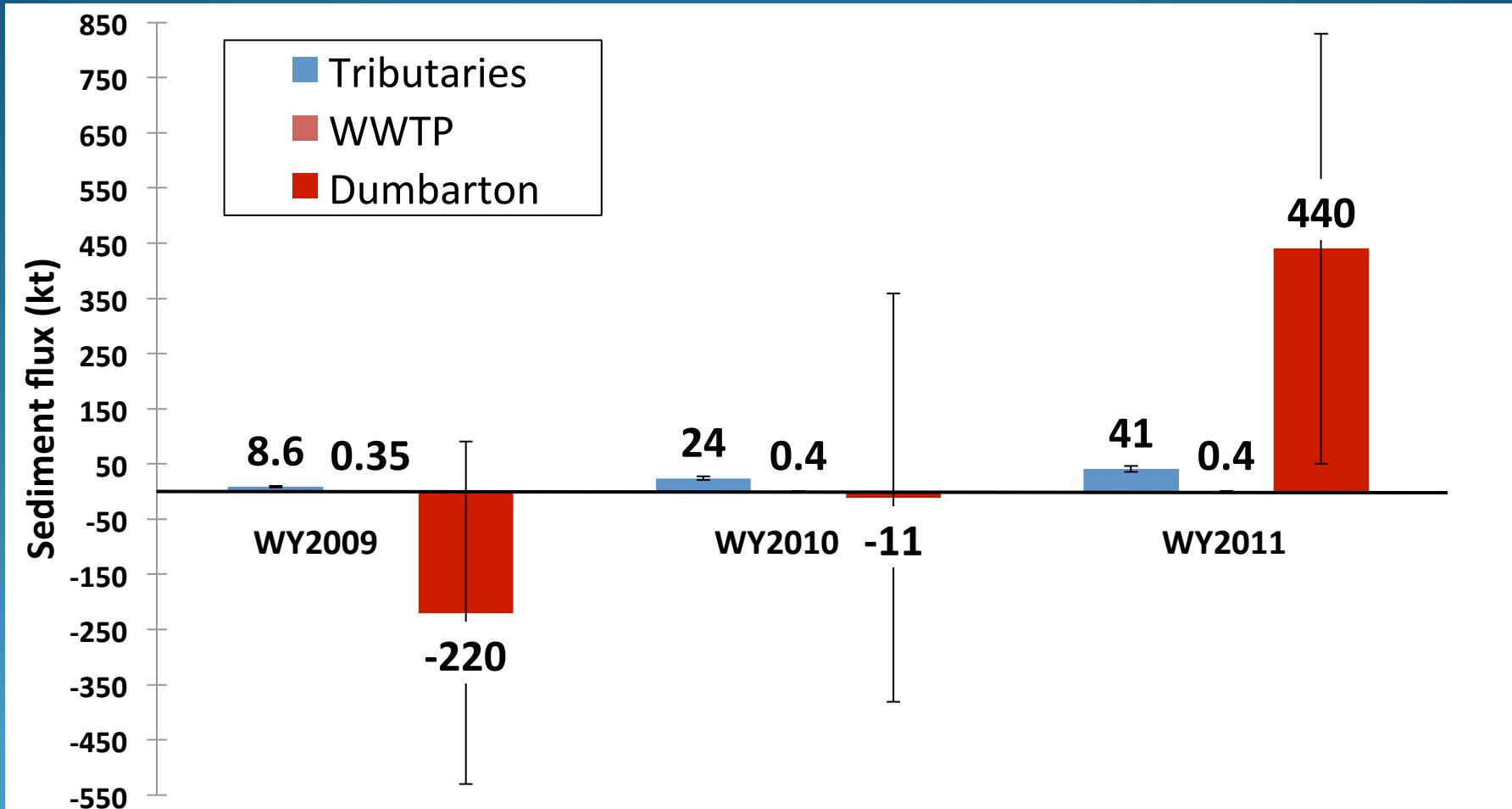


Shellenbarger, Wright and Schoellhamer

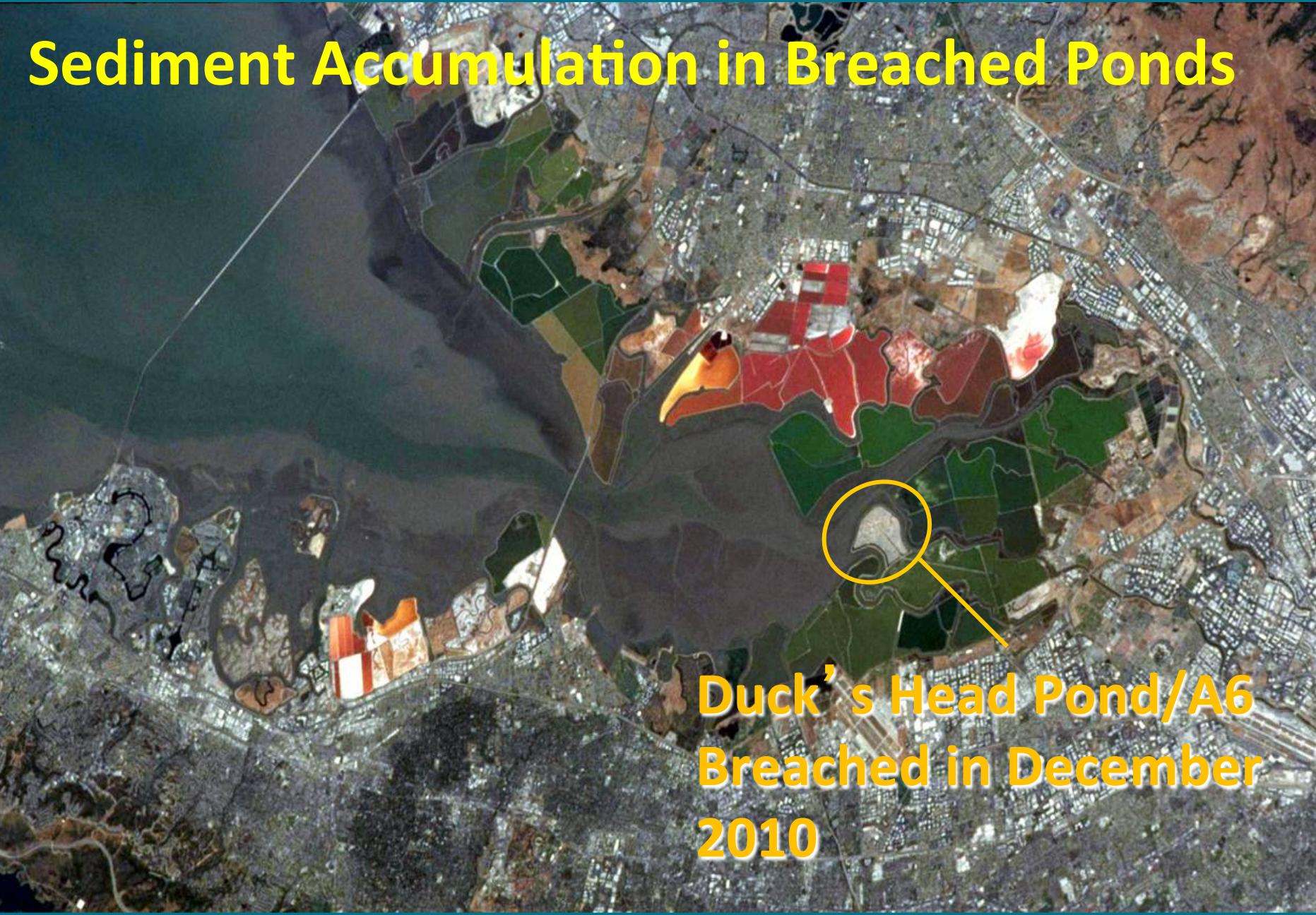


Sediment Supply tidal versus freshwater inflows

Positive values are seaward



Sediment Accumulation in Breached Ponds

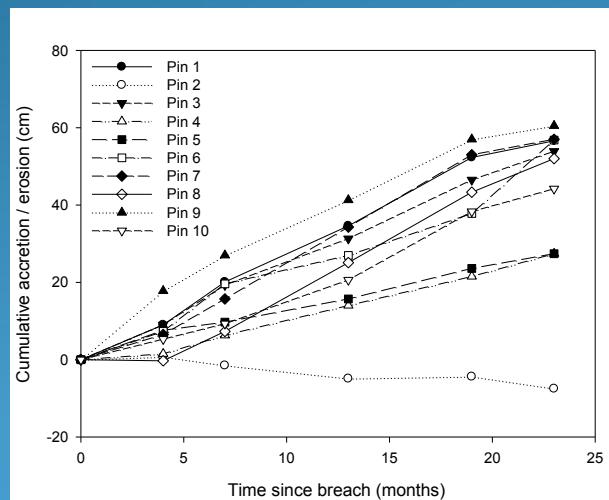


Duck's Head Pond/A6
Breached in December
2010

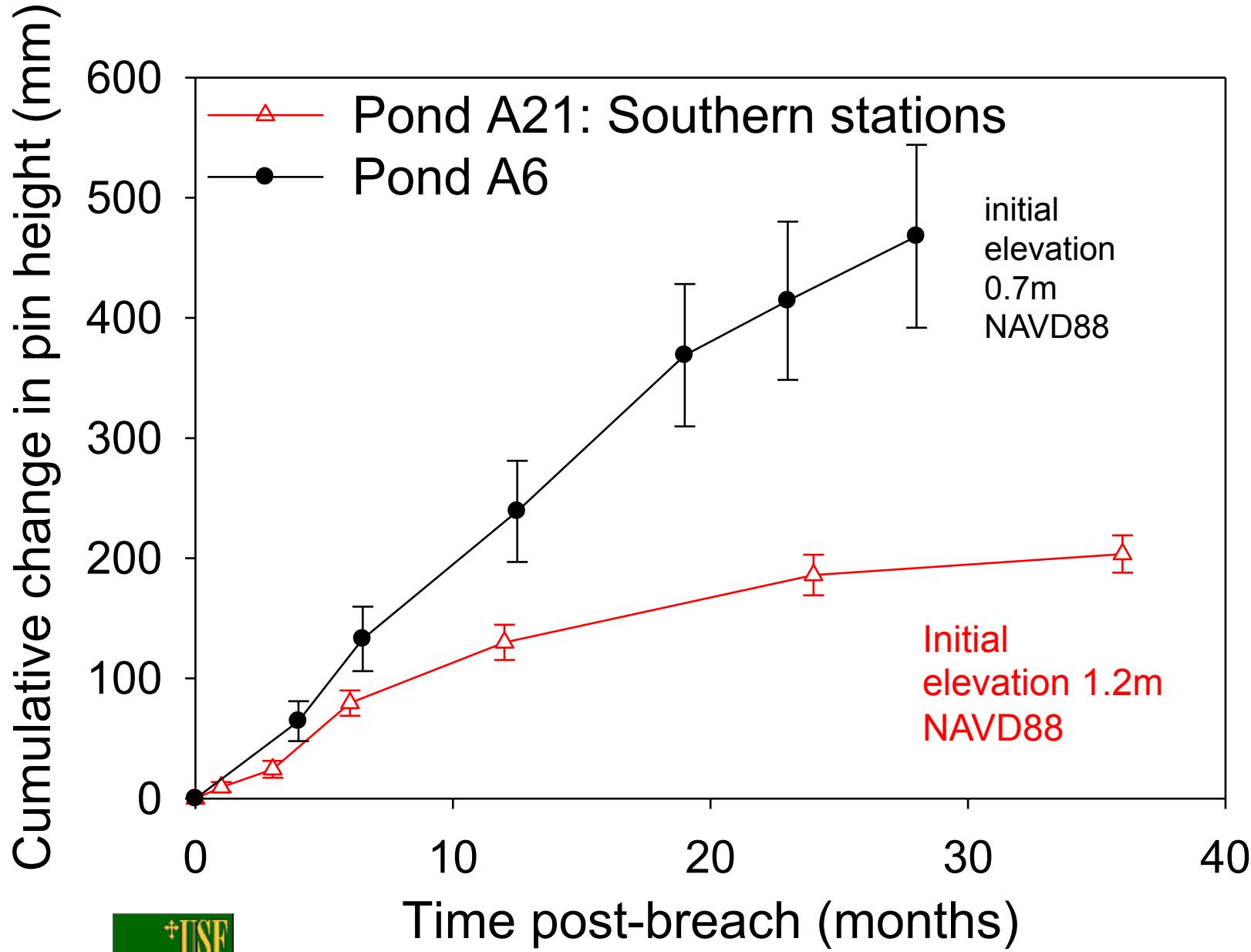
The “Ducks Head” Pond A6 sediment accumulation studies

Average deposition across all ten locations was 42.8 cm over 23 months.

Average rate of 22.2 cm/year



Sediment Accumulation in Breached Ponds

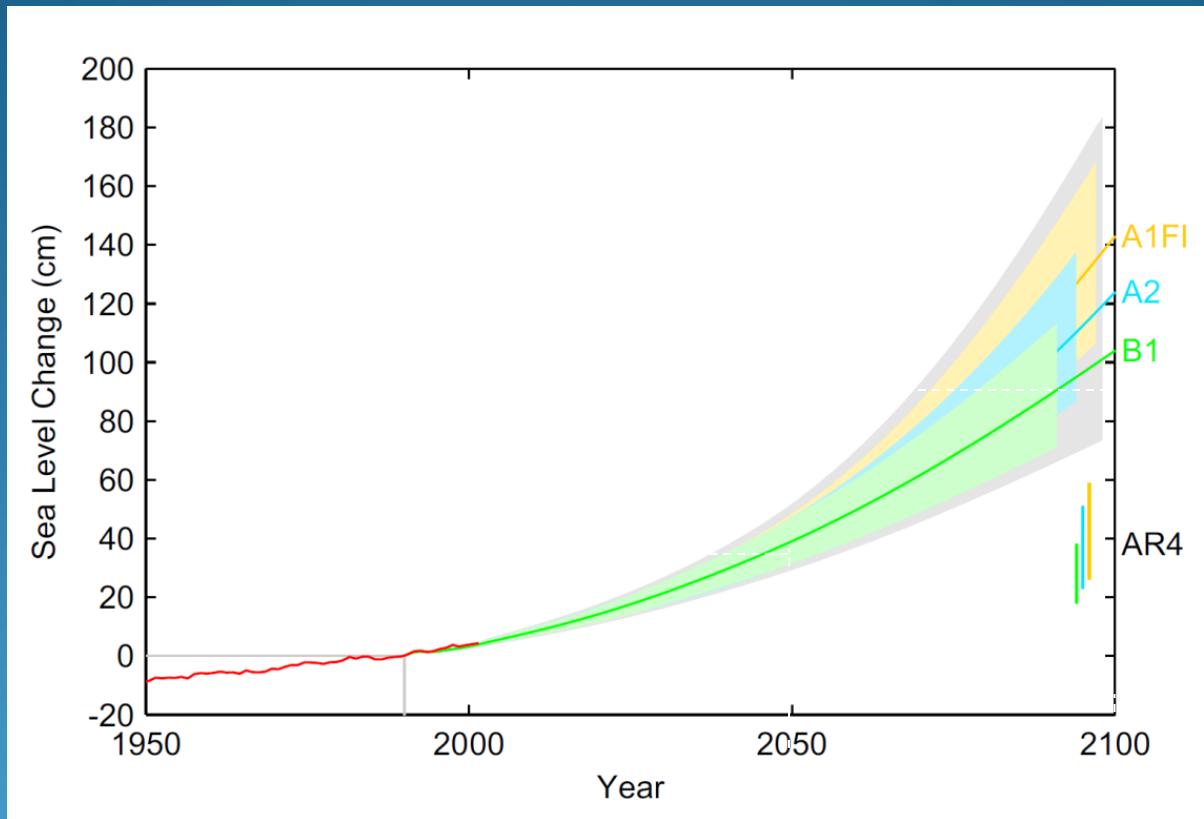


How will restoration affect mudflat habitat?

- ~ 2000 acres of mudflat habitat
- Traditional satellite imagery problematic
- Pilot Study using World View 2 or 3 with Coastal Blue Band
- Ground-truth



Sea Level Rise (SLR) Scenarios



$28 \pm 9.2 \text{ cm}^1$ SLR over 50 yrs = $0.6 \pm 0.2 \text{ cm/yr}$



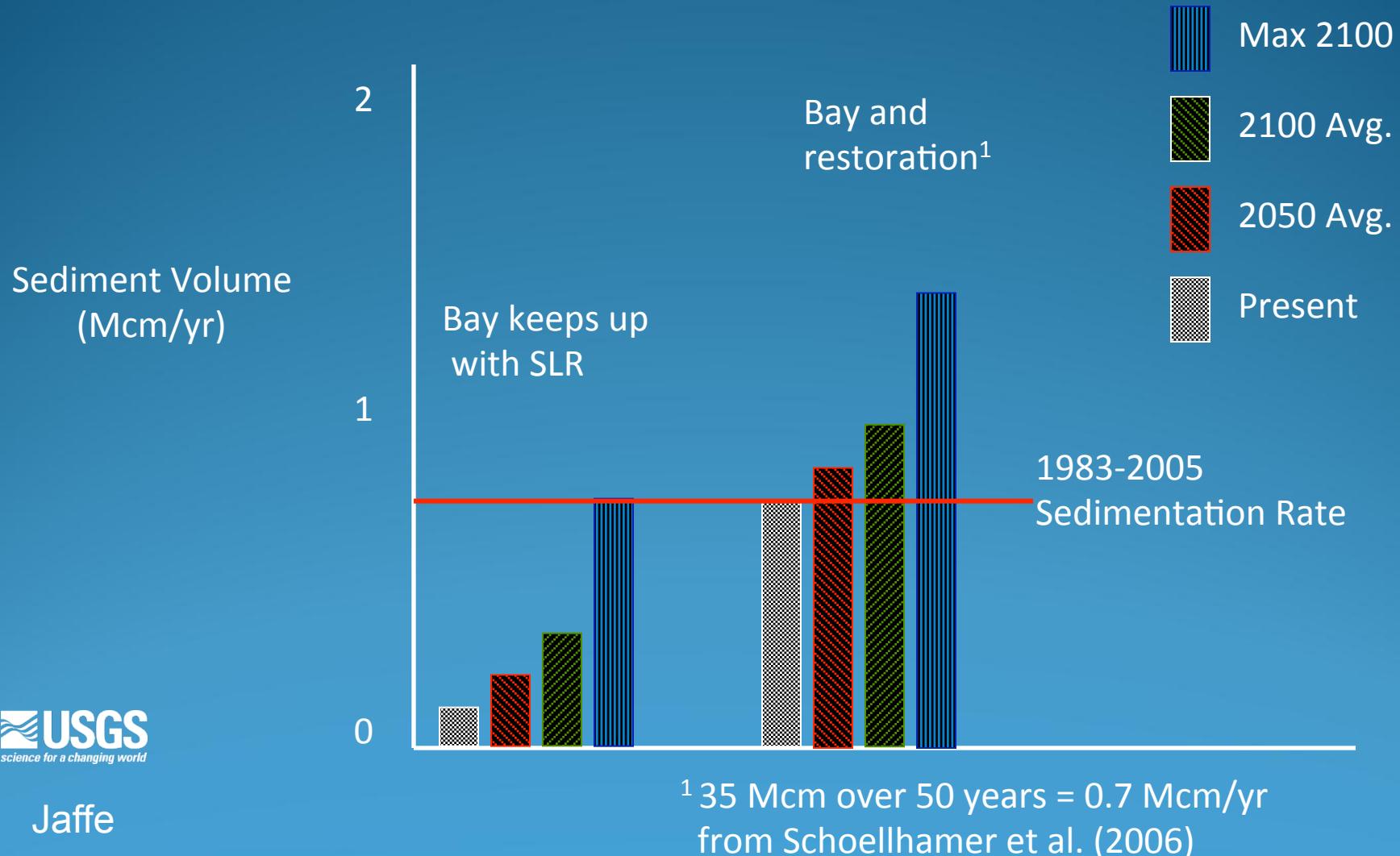
92 cm^1 SLR over 100 yrs = $0.9 \pm 0.3 \text{ cm/yr}$

¹ estimates from NRC, “*Sea-Level Rise for the Coasts of California, Oregon, and Washington*” (2012)

IPCC Emission
Scenarios,
semiempirical
SLR=f(T)

Last IPCC
Estimates (2007)

Estimated bay and restoration sediment “demand” from SLR



Management Response – Adaptation Strategies

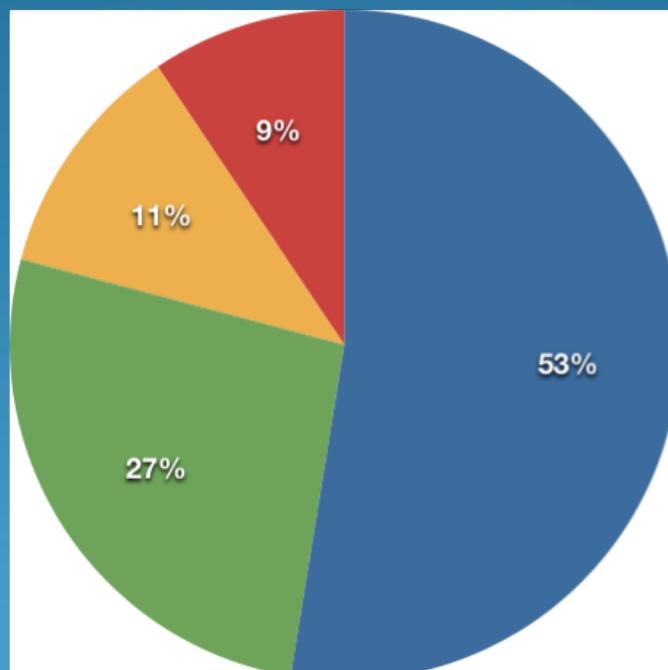
- Restore wetlands early rather than latter
- Use of upland fill to increase elevation
- Use of dredge material to increase elevation is being evaluated
- Creating high tide refugia – upland transition zones and marshmounds

southbayrestoration.org



Funding – Phase 1 ~\$8.9 million

Science Funds by Topic



- Mercury
- Fish
- Birds
- Habitat